

**STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
ENGINEERING DIVISION
DAM SAFETY PROGRAM
Honolulu, Hawaii**

April 9, 2021

**Board of Land and Natural Resources
State of Hawaii
Honolulu, Hawaii**

Regarding: Dam Safety Enforcement Action on Keaiwa Reservoir (HA-0049)
for Failure to Comply with Notice of Deficiency, February 18, 2020

Dam Owner: Edmund C. Olson Trust No. II (Edmund C. Olson, Trustee)
P.O. Box 280
Pahala, HI 96777

Location: Middle & Lower Moaula Camp, Pahala, Hawaii County
Tax Map Key: (3) 9-6-007:001, (3) 9-6-007:002

Background of Dam

The Keaiwa Reservoir is located in Pahala on the island of Hawaii and receives water from the Ka'ala'ala and Noguchi Tunnels and is used for agricultural irrigation purposes. The dam was constructed in 1920 and has a concrete lined earth embankment with a concrete parapet wall extension on the crest. The dam is currently classified as a Low Hazard¹ Potential Dam, although DLNR recommends the owner verify this based on possible structures in the inundation area on the owners property. This dam has a height of 32 feet and impounds 48 acre-feet (16 million gallons). See Attachment A for additional photos, maps, and diagrams.



Figure 1. Location and aerial view of the Keaiwa Reservoir in Pahala, Hawaii.

¹ The Low Hazard classification is based on the 2020 Phase 1 Inspection Report (Klienschmidt) statement that a breach would affect properties, but with no anticipated risk to life, primarily based on the 2008 Individual Assessment Report. However, since that study, Google Maps show a structure (believed to be the Ka'u Coffee Mill) within two miles, directly downstream of the Keaiwa Reservoir. Accordingly, DLNR suggests the owner examine the risk to life and reassess the dam's hazard classification.

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Since 2006, seven inspections have been conducted on the Keaiwa Reservoir:

- Consultant Kleinschmidt conducted a Phase 1 inspection in 2020.
- DLNR staff conducted visual inspections in 2006, 2009, 2012, 2014, and 2016.
- Consultant LFR conducted a Phase 1 inspection in 2009.

Primary Safety Issues

The primary safety issues of concern at this facility are:

1. Embankment stability. The embankment has experienced numerous seismic events and the concrete parapet wall is cracked in several locations. The embankment stability needs to be evaluated and the concrete parapet wall removed or retrofitted to be able to sustain the maximum credible earthquake.
2. The spillway needs to be evaluated for ability to pass the maximum design flood with minimum required freeboard as stipulated in the dam safety administrative rules (HAR Chapter 190.1)
3. Investigation of the outlet works for possible damage due to seismic events. The outlet works are controlled on the downstream side of the dam embankment, which places the outlet conduit under constant pressure loading during operation and more susceptible to internal erosion failures if there are defects/damage to the outlet works.
4. Concrete liner and other Embankment uncertainties and damages as detailed in Phase I inspection report of 2020. (See Appendix B for detailed findings summary from the 2020 phase I report conducted by Kleinschmidt).

Enforcement Actions & Owner Responses

On August 1, 2016, the DLNR sent a Notice of Dam Safety Deficiency (NOD) (see Attachment C) to the Edmund C. Olson Trust No. II ("Trust") indicating the dam was in poor condition and posed a threat to public safety due to one or more physical / operational conditions and deficiencies that were noted in previous inspection reports. The 2016 NOD required the following:

1. The reservoir be drained,
2. Submission of a remediation schedule,
3. Update the emergency action plan, and
4. Submission of monthly monitoring reports.

The Trust has kept the dam empty; submitted monthly monitoring reports; and updated its EAP in 2019. However, a remediation schedule was not provided. The Trust had discussed remediation options with their consultant and DLNR staff, but a formal permit has not been submitted.

On February 18, 2020, the DLNR issued an NOD (Attachment D) to the Trust indicating the dam was in unsatisfactory condition and a threat to public safety, specifically, identifying the dam's reservoir wall damage from an earthquake and that the spillway may not be able to pass the Probable Maximum Flood with the adequate freeboard.

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The 2020 NOD stipulated the compliance actions and deadline dates as presented in Table 1.

On March 11, 2020, the Trust responded in a letter to the DLNR (Attachment E), in which alternate deadlines were proposed by the Trust for the action items in the 2020 NOD, as summarized in Table 1 below. The table also provides status of the action items.

On December 14, 2020, DLNR staff met with the Trust to discuss the 2020 NOD and status of the action items. (See Meeting Notes in Attachment F). In the meeting, the Trust indicated possible plans to build a hydro power plant near the adjacent coffee mill, which will require four million gallons of water capacity to power the hydro plant, sourced either from the Keaiwa Reservoir, or from a new reservoir. The Trust plans to evaluate possibly modifying the Keaiwa Reservoir and possibly reducing its capacity to four million gallons, which would make it a non-jurisdictional size dam.

Table 1. Summary and status of February 18, 2020 NOD action items.

	Deadline	Action Item	Olson Trust Response	Current Status
1	4/01/2020	Contract with Consultant to complete engineering evaluation of deficiencies	3/11/2020: Trust proposed a new deadline of 6/1/2020. 12/14/2020: Trust indicated consultants were being interviewed and a selection would be made by 12/31/2020.	On 1/25/2021, Trust representative John Cross notified DLNR by email, saying the Trust recently contracted SSFM International as a consulting engineer.
2	5/30/2020	Install Water Level Monitoring System	3/11/2020: Trust requested the requirement to install a level monitoring system be deferred until the reservoir is approved by DLNR to impound waters. 12/14/2020: Trust indicated a level monitoring system would be installed by mid-Jan 2021. Subsequently, the Trust communicated plans to use and modify existing level gage equipment to transmit	The Trust failed to install a water level monitoring system on the reservoir by the DLNR deadline of 5/30/2020 and by the Trust's proposed deadline of mid-January 2021.

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			data for real-time monitoring system.	
3	6/30/2020	Submit Technical Studies	3/11/2020: Trust proposed a new deadline of 8/30/2020. 12/14/2020: Trust indicated appropriate studies will be completing once a consultant is hired.	The Trust failed to submit technical studies by the DLNR deadline of 6/30/2020 and the Trust's proposed deadline of 8/30/2020.
4	6/30/2021	Submit Dam Safety Permit Application	3/11/2020: Trust proposed a new deadline of 8/30/2021. 12/14/2020: Trust indicated the timeline for permit application submittal will depend on the consultant's proposed plan.	Permit application pending
5	6/30/2022	Start Construction	3/11/2020: Trust proposed a new deadline of 8/30/2022. 12/14/2020: Trust indicated the timeline for construction will depend on the consultant's proposed plan.	Construction start is subject to permit approval
6		Keep and maintain the reservoir empty under normal conditions. Submit monthly monitoring reports including reservoir water level, photos of the water level at the staff gage and other pertinent information to the Department.	The Trust has kept the reservoir empty and will continue to submit monthly reports.	The reservoir has been empty and monthly reports continue to be submitted by the Trust.

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Staff Recommendations

DLNR has informed the owner of the dam deficiencies and the regulatory requirements in multiple reports and notices dating back to 2006. Although the Trust has been maintaining the reservoir empty, no physical safety improvements have been completed on the dam structure. DLNR is recommending enforcement action by issuing fines, set forth in Attachment G, and mandating actions as follows:

1. The Board of Land and Natural Resources find the owner of the Keaiwa Reservoir (HA-0049), the Edmund C. Olson Trust No. II, in violation of HRS §179D-6(b)(17) for failing to address unsafe conditions, as ordered by in the February 18, 2020 Notice of Deficiency Letter, and subject to the following enforcement actions/penalties:
 - a. The Edmund C. Olson Trust No. II hired a consultant in January 2021, and missed the DLNR deadline of 4/1/2020 and owner proposed deadline of 6/1/2020. As the owner is taking proactive steps to get on a remediation schedule, the Edmund C. Olson Trust No. II will not be fined for missing the deadlines for hiring a consultant.
 - b. The Edmund C. Olson Trust No. II is fined \$10,000 for failing to submit technical studies by DLNR deadline of 6/30/2020 and owner proposed deadline of 8/30/2020, pursuant to HRS §179D-6(b)(17).
 - c. The Edmund C. Olson Trust No. II is fined \$5,000 for failing to install a water level monitoring system on the reservoir by DLNR deadline of 5/30/2020 and owner proposed deadline of mid-January 2021, pursuant to HRS §179D-6(b)(17).
 - d. The Edmund C. Olson Trust No. II shall pay all fines (total \$15,000) within sixty (60) days of the date of the Board's action.
 - e. In the event the Edmund C. Olson Trust No. II fails to comply with any order herein, the owner shall be fined an additional \$5,000 per day until the order is complied with.
2. Pursuant to HRS §179D-6(b)(17), the Edmund C. Olson Trust No. II shall be required to comply with the following remediation and monitoring actions by the deadlines shown:
 - a. By 7/1/2021:
Install Water Level Monitoring System: Install a fully functional, real-time reservoir water level gage with the readings accessible on the internet.
 - b. By 8/1/2021:

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Submit Technical Studies: Submit reports to document compliance with HAR §13-190.1-4. Submit topography map, Hydrologic/Hydraulic studies, stability analysis, and other applicable reports required to support the proposed improvements.

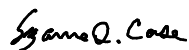
- c. By 12/1/2021:
Submit conceptual plans and a project timeline through construction completion.
- d. By 6/1/2022:
Submit Dam Safety Permit Application: Submit a complete dam safety permit application package (HAR §13-190.1-20) to bring the Keaiwa Reservoir into compliance with HAR §13-190.1-4.
- e. By 4/1/2023:
Submit proof of contract award for the construction contractor.
- f. By 6/1/2023:
Start Construction: Start any required Construction of the Dam Safety Permit improvements.

Respectfully submitted,



CARTY S. CHANG
Chief Engineer

APPROVED FOR SUBMITTAL:



SUZANNE D. CASE, Chairperson
Board of Land and Natural Resources

ATTACHMENTS:

- A Photos, maps, and diagrams.
- B Kleinschmidt Phase 1 Inspection Report, Summary of Site Observations & Findings, March 1, 2020.

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- C Notice of Dam Safety Deficiency, August 1, 2016.
- D Notice of Dam Safety Deficiency, February 18, 2020.
- E Letter from Olson Trust to DLNR, March 11, 2020.
- F Notes from meeting with DLNR and Olson Trust on December 14, 2020.
- G Summary Sheet of the Keaiwa Reservoir and Scorecard.

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ATTACHMENT A

Photos, maps, and diagrams.

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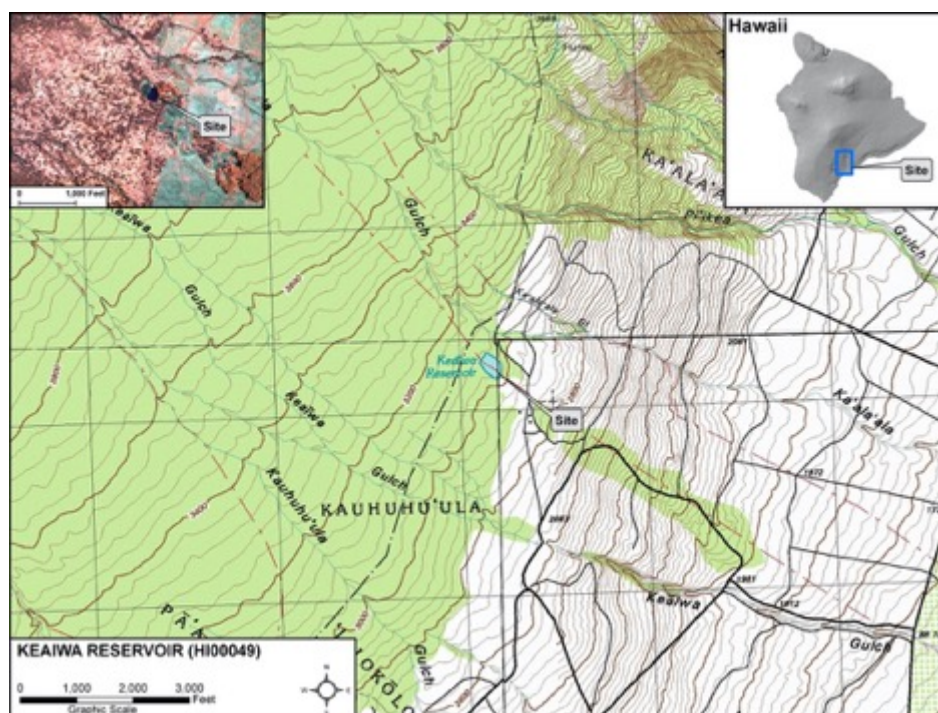


Figure 2. Location map of Keaiwa Reservoir (2008).

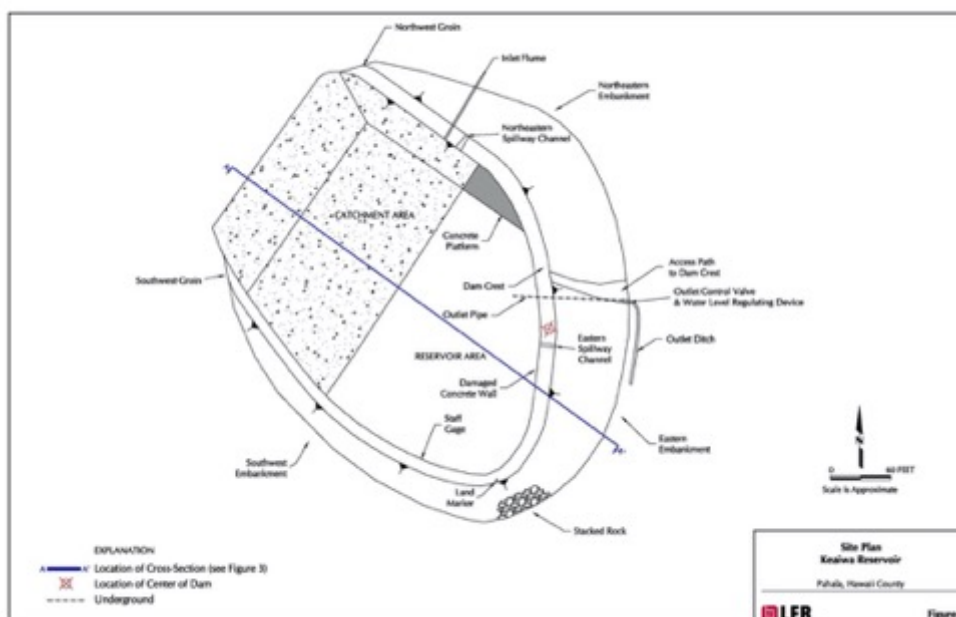


Figure 3. Site plan diagram of Keaiwa Reservoir (May 2009).

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Figure 4. Keaiwa Reservoir upstream embankment from NE embankment (April 2014).



Figure 5. Keaiwa Reservoir basin from NE embankment (April 2014).

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Figure 6. Keaiwa Reservoir basin (Mauka section) from NE embankment (April 2014).



Figure 7. Keaiwa Reservoir eastern embankment concrete lining cracking (April 2014).

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Figure 8. Keaiwa Reservoir embankment concrete lining cracking (April 2014).



Figure 9. Keaiwa Reservoir concrete lining cracking and displacement (April 2014).

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Figure 10. Keaiwa Reservoir concrete wall with deadman anchors (April 2014).



Figure 11. Keaiwa Reservoir cracks in spillway channel (April 2014).

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Figure 12. Keaiwa Reservoir erosion at downstream of spillway (April 2014).



Figure 13. Keaiwa Reservoir typical concrete floor panel cracking (April 2014).

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Figure 14. Keaiwa Reservoir crest (April 2014).



Figure 15. Keaiwa Reservoir typical trees growing out of downstream slope (April 2014).

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ATTACHMENT B

Kleinschmidt Phase 1 Inspection Report, Summary of Site Observations & Findings,
March 1, 2020.

2.0 SITE OBSERVATIONS AND FINDINGS

2.1 SITE OBSERVATIONS

The Keaiwa Reservoir was inspected during mid-day of April 13, 2018. The inspection party included Ms. Rebecca Allen and Mr. Nicholas Ciomei of Kleinschmidt, Mr. Jimmy Leung of the DLNR, and Mr. Frank Lorenzo as the Owner Representative. The weather was sunny with minimal cloud cover, with an approximate temperature of 70 degrees Fahrenheit. Rainfall had occurred in the area earlier that week, but the dam and surrounding area was mostly dry at the time of the inspection. The inspection included visual observations of accessible portions of the dam embankment, spillway, and outlet works.

Kleinschmidt and DLNR staff accessed the site by following Mr. Lorenzo in four-wheel drive vehicles on mostly earthen and gravel roads. Access to the dam required passing through multiple gates. A four-wheel drive vehicle is necessary during all weather conditions. The reservoir was empty on the day of the inspection.

The field inspection checklist and photographs taken during the inspection on April 13, 2018 are included in Appendix A and B, respectively. A site plan is presented on Figure 6, and locations of each photograph are presented on Figure 5, both presented in Appendix C. Appendix D contains inventory data on Keaiwa Reservoir.

2.1.1 UPSTREAM AND DOWNSTREAM SLOPES

The upstream slopes of the dam were lined with reinforced concrete (Photo 1). The concrete lining was in poor condition and not expected to fulfill its intended function. The approximately six-inch-thick concrete lining appeared to be in satisfactory condition at the catchment area (where the lining is sloped), and the southwest and northeast embankments (vertical wall sections). No significant issues were noted in these areas other than normal and expected surface deterioration of the concrete. The concrete lining for the southwest and northeast portions of embankment did not show any signs of significant cracking, movement, or degradation that would require immediate repairs (Photos 2 and 3). Some low grass and bush cover had begun to grow in locations along the concrete lining due to the prolonged dewatering of the reservoir.

Vegetation coming through the concrete lining should be removed, and seams through the lining should be repaired prior to refiling the impoundment.

The principle area of concern with the concrete lining was the eastern embankment lining (Photo 4). The lining was damaged during a 1975 earthquake. The damage included movement of the wall from vertical to 13 degrees over vertical, and tension cracks were visible in the concrete support columns. Remediation efforts were completed on the wall by installing a deadman type anchor system into the wall and embankment in 2009 and 2010. As part of the remediation efforts to install the deadman anchor system, a significant portion of the eastern embankment was excavated and not backfilled upon completion. This work was completed without permitting or DLNR notification. The embankment that was excavated to place the deadman anchors should be rebuilt to the crest of the concrete lining. Additional repairs, such as filling in the missing concrete and cracking in the concrete lining, should also be completed to ensure the structural integrity of the lining.

Four significant cracks in the concrete lining were noted during the 2018 inspection: a horizontal crack where the lining stepped down into the reservoir near the southwest end, two vertical cracks in the anchored portions of the eastern embankment lining, and a diagonal crack in the northeast lower vertical wall (Photos 5 and 6). All four cracks, at a minimum, should be sealed prior to refiling. Cracks should be monitored for changes over time prior to and immediately following refilling.

Due to the condition of the concrete lining, among other factors, the dam has been ordered to remain empty until repairs can be completed. Kleinschmidt agrees that the concrete lining, in its current condition, cannot be relied upon to act as originally designed. The liner may not act as the impermeable water-retaining feature, and the cracks in the liner can also focus seepage and create a preferential seepage pathway, which could initiate internal erosion.

The downstream slope has had significant vegetation maintenance since the 2009 Phase I Inspection. The eastern and southwestern portions of the embankment have been cleared of trees but do have low lying grasses and brush that have grown to a point where visual inspection will soon be impeded (Photos 7 and 8). The northeastern embankment had trees on the downstream slope that should be cut down, the root system removed, and backfilled appropriately (Photos 9

and 10). As the stumps and roots continue to decay and rot, they can potentially create voids and potential seepage pathways within the embankment and increase the potential for internal erosion to initiate, if the reservoir were to fill again. The trees, stumps, and roots along the embankment upstream and downstream slopes should be removed following guidance provided in the 2005 FEMA Technical Manual for Dam Owners, Impacts of Plants on Earthen Dams.

2.1.2 CREST

The dam crest appeared to be in fair condition. With an average crest width between 12 and 15 feet, the crest is used as a walking path around the reservoir. The embankment has had significant vegetation maintenance since the 2009 Phase I inspection, allowing for a proper visual inspection. The low-lying grass and woody vegetation should be maintained at a lower level to allow for a more thorough visual inspection (Photo 11). No trees were noted on the crest of the embankment. The crest of the embankment is greater than 1 foot below the top of the concrete lining along the southwest and northeast portions of the embankment. As indicated in Section 2.1.1 above, the eastern embankment was excavated and not backfilled during remediation efforts and is greater than 10 feet below the top of the concrete lining (Photos 12 and 13). In order to properly support the concrete lining and prevent instability, the elevation of the crest of the embankment should match the top elevation of the concrete along its entire length.

Animal paths and some small burrows from animal activity should be repaired as necessary. If left unrepaired, the burrows could result in the initiation slope instability or internal erosion.

2.1.3 UPSTREAM AND DOWNSTREAM TOES

The upstream toe is discussed in Section 2.1.1 above, as the upstream toe is lined with reinforced concrete.

The downstream toe was found to be in fair condition (Photos 14 and 15). The woody vegetation at the toe should be removed and the grasses maintained at an elevation to allow for visual inspection. There are no significant trees along the toe of the southwest and eastern embankment portions. The northeast embankment had some trees and overgrown vegetation on the toe at the northernmost end of the embankment. This area, however, was the minimum height section of the embankment, and was above the normal operating water surface elevation when the reservoir

was in operation. This area should be cleared of vegetation and root systems to allow for a complete visual inspection of the embankment and to prevent initiation of internal erosion.

2.1.4 ABUTMENT AND GROIN AREAS

The southwest abutment and groin area was mostly clear of vegetation (Photo 16). The area was found to be in fair condition, with no observed deficiencies.

The northeast abutment and groin area was not able to be inspected due to significant tree growth and heavy low-lying vegetation (Photo 9). This area should be cleared of vegetation to allow for a complete visual inspection of the abutment and groin.

2.1.5 OUTLET WORKS

The outlet works, which consists of a 12-inch diameter metal pipe through the eastern embankment, appeared to be in fair condition; however, it was not operated on the day of the inspection (Photos 17 through 19). The conduit, along with the concrete lined ditch downstream of the concrete headwall where the conduit daylights after passing through the embankment, appeared to be in good working condition. Outlet control is located downstream of the concrete headwall, downstream from the embankment toe. Water through the outlet works is routed downstream for irrigation through the outlet ditch located at the end of a 6-inch diameter PVC pipe.

The reservoir is currently empty, and therefore, the outlet works valve is kept open to prevent any impoundment from forming. Prior to refilling, consideration should be given to installing upstream outlet control to prevent a pressurized conduit from penetrating the embankment. If a leak were to occur along the current pressurized outlet conduit, there is potential for pressurized leaks and excessive erosion or internal erosion to initiate along the outlet conduit. Outlet works should have upstream control to prevent these pressurized leaks and filters should be considered around all conduits through embankments to help reduce the likelihood of progressing internal erosion.

2.1.6 SPILLWAY

Two concrete-lined channels that pass through the dam crest were originally intended to operate as spillway channels. The eastern embankment channel, which was originally a 3-foot by 3-foot notch in the concrete lining with a concrete channel, was removed during historic remediation efforts of the eastern concrete lining (Photo 20). The 3-foot by 3-foot notch in the concrete lining remains; however, the channel downstream of the lining was removed during excavation of the eastern embankment.

The second channel was located on the northeast embankment (Photo 21). The channel was 6 feet wide at the upstream end, and 2.5 feet wide at the downstream end. The 16-foot-long channel is approximately 3 feet deep along its entire length, with vertical concrete side walls. The channel separated along the invert and side walls at the interface with the concrete reservoir lining, likely due to embankment settlement (Photo 22). This area will need to be rehabilitated before the reservoir is put back into service as erosion of the underlying embankment could quickly occur by water flowing through the separated joint. Flows exiting the concrete spillway channel will likely cause erosion issues of the embankment toe, downstream slope, and likely result in headcutting if prolonged flow occurs due to lack of erosion protection. Headcutting could eventually work back into the embankment and result in a failure of the structure. Discharge from the spillway channel should flow onto an armored surface to protect the embankment from erosion and direct flow away from the toe.

2.1.7 DOWNSTREAM CHANNEL

There was no clearly defined downstream channel for the northeast embankment spillway. Flows from the embankment could result in erosion along the embankment toe and downstream slope if left in current condition. Natural topography downstream of the spillway will likely direct flows into the Ka'ala'ala Gulch.

2.1.8 INFLOW

The reservoir has a very small drainage area of 0.00294 square miles. Therefore, inflow to the reservoir historically was obtained via flume system that conveyed water from the Noguchi Tunnel, approximately 2 miles north of the reservoir (Photo 23). The flume has fallen into disrepair but remains in place despite lack of use. Water is now conveyed into the reservoir via a

12-inch PVC pipe from the Noguchi Tunnel, and 3-inch PVC pipe from the Ka'ala'ala Tunnel. As the reservoir is operated in an empty condition, the pipes are shut off to prevent an impoundment from forming and tunnel flows are diverted away from the reservoir.

2.1.9 RESERVOIR AND RESERVOIR RIM

The reservoir was empty due to the required drawdown until repairs can be made to the dam to ensure its safety. The outlet works are kept open to prevent rainwater from filling the reservoir, and inlet flows are diverted away from the reservoir. The upstream face of the reservoir was lined with concrete, and a water level gage was painted on the southwest portion of the lining (Photos 3 and 24). The painted gage has faded over time and requires repainting prior to refilling the reservoir. The reservoir rim consists solely of the concrete lining, there is no natural ground in the reservoir rim.

2.1.10 SITE ACCESS

Access to the site requires a four-wheel drive vehicle and passing through multiple gates. The gates are tied off and loosely shut to keep grazing animals in desired locations and does not require a key to pass through. Parts of the access road allow for two different directions to be taken, which would allow for access even if a washout of the road from heavy rains were to occur at some locations.

2.2 STATUS OF CURRENT REMEDIAL ACTIONS OR MODIFICATIONS

The owner has indicated a plan to repair the dam and make suitable to be filled. A specific timeline for completing the required repairs has not yet been determined. Additionally, the owner is considering installation of a small, in-line hydroelectric unit downstream of the site. The reservoir would then be used as supplemental water for the hydroelectric unit during periods of low flow or repair to the conveyance structures.

2.3 OVERALL CONDITION OF THE DAM

The condition of the dam is UNSATISFACTORY due to the condition of the concrete lining and spillway, the capacity of the spillway is unknown, the stability of the embankment is unknown, and the condition of the outlet conduit is unknown. The reservoir should remain drained until required repairs are made to ensure integrity of the water-retaining structures.

2.4 POTENTIAL FAILURE MODES

Identifying potential failure modes (PFMs) of a project provide a better understanding of the risks posed by the dam during normal, flood, and seismic loading conditions. Based on the site inspection and data review of the structure, there are a number of PFMs that should be considered at the site. These are listed below. The list is not a comprehensive list of all PFMs, but those identified as critical by the inspection team.

- Embankment instability during normal, flood, and seismic loading conditions.
- Internal erosion through the embankment during normal and flood loading conditions.
- Internal erosion along/into the outlet works during normal and flood loading conditions.
- Instability of the concrete liner during normal, flood, and seismic loading conditions.
- Internal erosion due to the damage of the concrete liner during seismic loading conditions.
- Overtopping during a flood loading condition.
- Headcutting and erosion due to spillway flows during a flood loading event.

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Failure to Comply with Notice of Deficiency, February 18, 2020

ATTACHMENT C

Notice of Dam Safety Deficiency, August 1, 2016.

DAVID Y. IGE
GOVERNOR OF HAWAII



**STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES**

ENGINEERING DIVISION
POST OFFICE BOX 373
HONOLULU, HAWAII 96809

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

KEKOA KALUHIWA
FIRST DEPUTY

JEFFREY T. PEARSON, P.E.
DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
BUREAU OF CONVEYANCES
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

AUG 01 2016

Mr. John Cross
Edmund C. Olsen Trust No. II
PO Box 280
Pahala, HI 96777

Dear Mr. Cross:

**KEAIWA RESERVOIR (HA-0049), HAWAII
NOTICE OF DAM SAFETY DEFICIENCY**

This letter is to notify you that the subject regulated dam/reservoir was determined to be in poor condition and a threat to public safety due to one or more physical / operational conditions and deficiencies that were noted in previous inspection reports. The condition determination for this facility was established from the Department of Land and Natural Resources (Department) statewide investigations from 2007-2009 and subsequent dam safety inspections.

Your immediate action is required of the following:

1. Drain the reservoir drained:
 - a. Maintain the operating water level in the reservoir to empty.
 - b. Provide photographic documentation of the lowered water level at the staff gage within fifteen (15) days of this notice.
 - c. Failure to maintain the water level below this restricted level would be subject to civil resource violation penalties in the amount of \$ 1,000 for the first violation.
2. Submit a Remediation Schedule:
 - a. Submit a schedule to the Department detailing when deficient conditions will be corrected, within twenty (20) days of this notice. (A sample format is attached)
3. Update the Emergency Action Plan:
 - a. If your EAP has not been updated in the last 12-months, update and distribute updated copies within thirty (30) days of this notice. An Online tool is available to update the EAP. Please contact the Department if you need assistance.
4. Submit monthly monitoring reports:
 - a. Take weekly readings of applicable water level, seepage rates, etc and relevant photos and submit to the Department assigned engineer's email: jimmy.m.leung@hawaii.gov, at the beginning of each month for the previous month.

Mr. John Cross
Keaiwa Reservoir (HA-0049), County
Notice of Dam Safety Deficiency
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- b. A sample log sheet is attached. The log sheet shall be tailored to the site specific needs for the facility. Please contact the Department for an electronic copy to customize.
- c. The initial report is due the first month following receipt of this notice.

Continued operation and maintenance of the facility is still required and all previously noted deficiencies still need to be addressed. Failure or delinquency to comply with the above stated actions may result in additional penalties and/or Board of Land and Natural Resources actions. Please contact Mr. Jimmy Leung of my staff at (808) 587-0238 should you have any questions regarding this matter.

Sincerely,



CARTY S. CHANG
Chief Engineer

Attachment

_____ Reservoir Daily Log
 Month/Year: _____

Date	Rainfall	Reservoir Water Level Height (gage)	Intake flow rate:	Outlet flow rate:	Maintenance	Seepage flow rate:	Remarks Top of Dam gage reading = __ Spillway gage reading = __
1							
2							
3							
4							
5							
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Board of Land and Natural Resources

Enforcement Action on Keaiwa Reservoir (HA-0049) for
Failure to Comply with Notice of Deficiency, February 18, 2020

ATTACHMENT D

Notice of Dam Safety Deficiency, February 18, 2020.



**STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES**

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

Feb 18, 2020

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

ROBERT K. MASUDA
FIRST DEPUTY

M. KALEO MANUEL
DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
BUREAU OF CONVEYANCES
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

Mr. Edmund C. Olson
Edmund C. Olson Trust No. II
P.O. Box 280
Pahala, HI 96777

Certified Mail

Dear Mr. Olsen:

**KEAIWA RESERVOIR (HA-0049), HAWAII
NOTICE OF DAM SAFETY DEFICIENCY**

The subject regulated dam/reservoir has been classified to be in an unsatisfactory overall condition and a threat to public safety due to one or more physical / operational conditions and deficiencies identified by the Department of Land and Natural Resources (Department). This Notice of Dam Safety Deficiency supersedes the conditions stipulated in previously issued notice of deficiencies.

The subject facility is classified as a High Hazard Potential dam, as failure could jeopardize the lives of the downstream public. The dam's reservoir wall was cracked and damaged from an earthquake and the spillway may not be able to pass the Probable Maximum Flood (PMF) with adequate freeboard as required by Hawaii Administrative Rules (HAR) Chapter 13-190.1.

Pursuant to Hawaii Revised Statutes (HRS) 179D-6, you are required to take the following remediation, and maintenance and monitoring actions, by the deadlines indicated:

1. **Remediation Schedule:**

By 4/01/2020:

- a. **Contract with Consultant:** Engage the services of a qualified consultant in dam-related work to complete an engineering evaluation of the deficiencies at the subject facility. Provide the consultant name, contact phone number and firm name to the Department by this date.

By 5/30/2020:

- b. **Install Water Level Monitoring System:** Install a real-time reservoir water level gage with the readings accessible on the internet.

By 6/30/2020:

- c. **Submit Technical Studies:** Submit reports to document compliance with HAR §13-190.1-4. Submit topography map, Hydrologic/Hydraulic studies, stability analysis and/or other applicable reports required to support the proposed improvements.

By 6/30/2021:

- d. **Submit Dam Safety Permit Application:** Submit a complete dam safety permit application package (HAR §13-190.1-20) to bring your facility into compliance with HAR §13-190.1-4

By 6/30/2022:

- e. **Start Construction:** Start any required Construction of the Dam Safety Permit improvements.

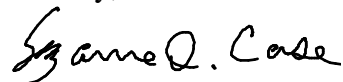
2. **Owner Maintenance and Monitoring:**

- f. Keep and maintain the reservoir empty under normal conditions.
- g. Submit monthly monitoring reports including reservoir water level, photos of the water level at the staff gage and other pertinent information to the Department's Dam Safety Program via email. Monthly reports shall be due by the first week of the next month. The initial report is due the first month following receipt of this notice.

Email reports to: dlmr.en.fcds@hawaii.gov

Failure to comply with the Remediation and Maintenance and Monitoring actions by the indicated deadlines may result in penalties and other actions by the Board of Land and Natural Resources pursuant to HRS § 179D-6 and 8 and HAR § 13-190.1-5. Please contact Edwin Matsuda of my Engineering Division staff at (808) 587-0268 should you have any questions regarding this matter.

Sincerely,



SUZANNE CASE
Chairperson

Board of Land and Natural Resources

Enforcement Action on Keaiwa Reservoir (HA-0049) for
Failure to Comply with Notice of Deficiency, February 18, 2020

ATTACHMENT E

Letter from Olson Trust to DLNR, March 11, 2020.

EDMUND C. OLSON TRUST No.2

HILO: 26-238 Hawai'i Belt Road · Hilo, Hawai'i 96720 KA'U: PO Box 280 · Pahala, Hawai'i 96777

Date:

Ms. Suzanne D. Case, Chairperson
Board of Land and Natural Resources
P.O. Box 621
Honolulu, Hawaii 96809

DEPT OF LAND
& NATURAL RESOURCES
STATE OF HAWAII

2020 MAR 13 AM 8:05

RECEIVED



Re: 2/18/2020 letter regarding Notice of Dam Safety Deficiency, Keaiwa Reservoir, (HA-0049)

Dear Ms. Case:

We are in receipt of your letter regarding the Keaiwa Reservoir and demand to take certain remedial actions by specified dates. On February 27, 2020 Mr. Edmund C. Olson, Trustee and John C. Cross, talked to Mr. Edwin Matsuda about the demand, timeline presented, and the current status of the reservoir (EMPTY).

Mr. Olson and Cross emphasized that despite the reservoir being classified as "High Hazard Potential Dam" by DLNR, the actual hazard to the surrounding lands and downstream crops and facilities is extremely low to non-existent. Mr. Matsuda explained the actions being imposed by Engineering Division on all owners of Dams in the State that may have deficiencies, especially those designated as High Hazard Potential. We understand the concerns of the Board and the Board's desire to get these issues taken care of sooner rather than later.

That being said, the Trust is proposing a revised timeline that will achieve the goals of the Board and that of the Trust. At this moment the Trust is contemplating two possible actions, 1) Complete a Remediation Study and Plan for the Keaiwa Reservoir, or 2) Complete a Decommissioning Plan to remove the Dam from service. Both of these actions will involve the DLNR Engineering Division to be involved as per HAR 13-190.1.5. No matter what action we take, repair or decommission, the DLNR Engineering Division will be part of the process. These actions will be costly to the Trust and decisions to spend these funds must be made carefully and with proper engineering studies behind it. It is not appropriate to rush to a contract with an engineering firm by 4/01/2020.

The Trust proposes a modest revision to the Schedule proposed by DLNR:

Contract with Consultant: The Trust would like to use the deadline date of 6/01/2020 to interview and receive quotes to provide these services. As soon as possible we will provide the name and phone number of the firm to the DLNR, Engineering Division.

Install Water Level Monitoring System: The reservoir is currently empty and will remain as such until remediated or decommissioned. It is not appropriate for us to install a "real-time" water level gauge accessible by internet in the time frame stated by DLNR. Certainly, should the reservoir be remediated and is approved by DLNR to once again impound water, the Trust will install a gauge device that can be accessed by internet. The Trust requests that this requirement be deferred until the reservoir is approved by DLNR to impound waters.

Submit Technical Studies: The Trust hired engineering firm "Arcadis" in 2014. Much of the technical Studies that DLNR is seeking exist within this report. Engineering staff of DLNR likely reviewed a "Draft" form of this report, however, a "Final" version was not completed. The report needs to be updated and brought current. The Trust proposes that a deadline of approximately August 30, 2020.

Submit Dam Safety Permit Application: Depending on the decisions made to remediate or decommission, the Trust would like to propose that the Permit Application be submitted by August 30, 2021.

Start Construction: The Trust would like to propose the deadline date of August 30, 2022.

Owner Maintenance and Monitoring: The Trust is pleased to report that this requirement has been completed and is ongoing.

- 1) **Keep the reservoir empty:** The reservoir has remained empty and is not able to impound waters. Further to that, protocols have been established that monitor and inspect the reservoir on a weekly basis or sooner (as conditions may demand), so that waters are not retained. See attached Addendum to EAP for Empty State Status of Keaiwa Reservoir. This report with attached photographs was included within the recently completed Emergency Action Plan for Keaiwa Reservoir published on the DLNR Hawaii Dams website in October 2019.
- 2) **Submit Monthly Monitoring Reports:** Attached herewith are three years of monthly reservoir monitoring reports by Dam Operator Frank Lorenzo. As you will read his notes state conditions of weather, natural events that cause inspection (earthquake, wind, and rain). Over the past 38 months of weekly inspections, the reservoir has never noted to retain water. Beginning immediately the Trust will be sending these monthly inspection logs to the dlnr.en.fcds@hawaii.gov website.

Please let us know if these modest modifications to your timeline can be accommodated. Should you need to discuss any of these actions or timelines, please contact John C. Cross at cross.johnc@gmail.com or at 808-987-4229.

Sincerely,

 3/11/2020

Edmund C. Olson, Trustee
Edmund C. Olson Trust No.2

CC: Paul Alston, Dentons
Jeff Clark
Troy Keolanui

Attachments: EAP Addendum, Empty State Reservoir
2017 Monthly Inspection Logs

EMERGENCY ACTION PLAN (EAP) KEAIWA RESERVOIR

Addendum for Empty State Reservoir

State Dam Site # HA – 0049
Pahala, Island of Hawaii, 96777

Dam Owner: The Edmund C. Olson Trust No.2

OVERVIEW **Dated September 30, 2019**

The Keaiwa Reservoir is currently maintained at **EMPTY**, drained of all water. The reservoir is not going to be filled until a proper repair plan is approved by the State of Hawaii, DLNR, Engineering Division. The Dam owner intends to repair any cracks to the concrete liner, install appropriately sized spillways, compact and properly grade the downslope embankment, and line the reservoir with 60mil HDPE liner.

In its current empty state the reservoir has little to no chance of releasing waters in the event of a catastrophic failure of the dam embankment. The 12" mainline valve to the reservoir is currently in the CLOSED position. Despite its empty state, monitoring of the dam, structures, and ability to impound water must be monitored.

The attached EAP follows the template designed by the State DLNR's website and is constructed as if the reservoir was filled and in operation. The contact names and numbers remain valid for current contact purposes.

Reservoir Setting

The Keaiwa Reservoir has a maximum capacity of 12.8 million gallons. It is located at the 3,100' elevation in the ahupua'a of Keaiwa above Wood Valley Road. The closest community is the town of Pahala, approximately 3.5 miles to the south west. Several large stream beds and gulches separate the town from the reservoir. Due to the porous nature of the rocky a'a soils immediately down slope and the relatively small capacity of the reservoir, any water volumes from a future breach of a filled reservoir will not travel significantly far from the Dam. The sugarcane plantation installed many conservation ditches that catch and divert water from the agricultural fields to the streams on either side of the downslope areas. This network of diversion ditches protects any crops, livestock and employees or farming tenants downslope.

Current Contacts

Administrative Contact: John C. Cross, Land Consultant, 808-987-4229
(Administrative Manager for Reservoir Compliance)

Primary Contact: Louis Daniele, General Manager, Cell: 808-936-5550; Office 808-928-0550
(On Site General Manager of System and Reservoir Operations)

Dam / Reservoir Operator: Frank Lorenzo, 808-896-0221

Alternate Contact: Dan Aldridge, Land Manager, 808-989- 4128

EAP addendum for EMPTY State Keaiwa Reservoir:

Emergency Conditions that may require immediate inspection and monitoring of the current empty state Reservoir and Dam include:

- 1) **Excessive and continuous heavy rainfall.** Operator and/or manager must inspect the reservoir to insure that the reservoir does NOT impound water. Check to make sure outlet works is open and venting any rain fed waters.
- 2) **Earthquake.** Operator and/or manager must inspect the reservoir for damage to walls, embankment and outlet works. Ensure that reservoir outlet works is free of debris and not able to impound waters.
- 3) **Excessive wind or other storm related events.** Operator and/or manager must inspect the reservoir for surrounding tree fall, damage to walls, embankment and outlet works. Ensure that reservoir outlet works is free of debris and not able to impound waters.

Submitted By:

John C. Cross, Land Consultant
Edmund C. Olson Trust No.2

KEIAIWA RESERVOIR WEEKLY LOG

MONTH/YEAR: DECEMBER 2017

WEEK ENDING DATE	RAINFALL INCHES	RESERVOIR WATER LEVEL HEIGHT GAUGE	INTAKE FLOW RATE	OUTLET FLOW RATE	MAINTENANCE	SEEPAGE FLOW RATE	REMARKS
12/10/17	0.7	0	0	0	checked roads and valves	0	NO ISSUES
12/17/17	0.2	0	0	0	mowed and weedwack	0	NO ISSUES
12/24/17	3.7	0	0	0	checked roads and valves	0	Lots of rain this week Earthquake on 12/22/17
12/31/17	0.4	0	0	0	checked roads and valves	0	NO DAMAGE NOTICED NO ISSUES
TOTALS	5.0						

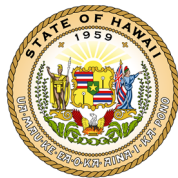
SIGNATURE: Frank Lopez

Board of Land and Natural Resources

Enforcement Action on Keaiwa Reservoir (HA-0049) for
Failure to Comply with Notice of Deficiency, February 18, 2020

ATTACHMENT F

Meeting Notes from meeting with DLNR and the Olson Trust on December 14, 2020.



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
ENGINEERING DIVISION
POST OFFICE BOX 373
HONOLULU, HAWAII 96809



MEETING NOTES

Keaiwa Reservoir Status Update Meeting

Date: Monday, December 14, 2020

Time: 2:30-3:30 pm

Meeting Coordinator: Tony Koyamatsu, DLNR

Attendees: Edmund Olson, Olson Trust
Jeff Clark, Olson Trust
John Cross, Olson Trust
Paul Alston, Olson Trust
Edwin Matsuda, DLNR
Kristen Akamine, DLNR

Conference Bridge: 808-451-0217, ID 612419

Agenda

-
- | | | |
|---|----------------|---|
| 1 | Status for dam | <ul style="list-style-type: none">• Current plan for dam• Consultant retained• Water level gage• Technical studies• Permit application timeline• Construction timeline• Monthly reports |
|---|----------------|---|
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- | | |
|---|----------------------------|
| 2 | Other items for discussion |
|---|----------------------------|
-

Discussion

1. Current plan for the dam. The Olson Trust plans to build a hydro power plant near the coffee mill, which will require four million gallons of water capacity to power the hydro plant, sourced either from the Keaiwa Reservoir, or from a new reservoir. The Trust will evaluate modifying the Keaiwa Reservoir and reducing its capacity to four million gallons, which would bring it to a non-jurisdictional size dam.
2. Engineering Consultants. The Trust is soliciting proposals from engineering firms to conduct studies and develop designs to modify the reservoir, and the Trust expects to select a firm by

12/31/20. The Trust received a proposal from Engineering Partners, Inc. and is currently in discussion with Wesley Segawa & Associates. The Trust intends to share with the selected engineering firm previous studies on the dam conducted by Arcadis Honolulu. DLNR does not have an approved list of Dam Safety consultants but can offer a list of consultants who submitted qualifications for consideration in response to DLNR's annual Request for Qualifications for Dam Safety engineering firms. The Trust was interested in reviewing the list.

3. Level Gage

- a. Ed Matsuda reiterated the requirement for the dam to have a water level monitoring system so the DLNR and the Hawaii County Civil Defense Agency can monitor water level real-time and in particular during storm events.
- b. Ed discussed the option of having the USGS install a water level monitoring system, which would be battery powered with solar panels and have the ability to transmit water level data by satellite for on-line monitoring. The Trust was interested in the concept and requested contact information for the USGS.
- c. The Trust expects to contact the USGS by 12/31/20 and to have a level monitoring system installed by 1/15/21.
- d. After the meeting, John Cross emailed to say the Trust will use an existing level gage transducer and radio link to monitor water level in the reservoir. However, a solar panel power supply needs to be integrated and the data needs to be transmitted to the coffee mill. The Trust will keep the DLNR updated on progress.

4. Monthly Reports. Tony Koyamatsu acknowledged the Trust submitting monthly reports via email from Frank Lorenzo, which is appreciated.

5. Timeline for permit submittal and construction. The Trust intends to select a consultant and immediately proceed with studies and design work. The timeline for submitting a permit application and starting construction will depend on the consultant's proposed schedule, but the Trust anticipates meeting the deadlines discussed in the DLNR NOD letter from 2/18/20 – submitting a permit application by 6/30/21 and starting construction by 6/30/22.

Action Items

No.	Item	Owner	Status
1.	USGS contact information for water level monitoring system.	DLNR	Completed
2.	List of consultants who submitted qualifications for consideration in response to DLNR's annual Request for Qualifications for Dam Safety engineering.	DLNR	Completed

Board of Land and Natural Resources

Enforcement Action on Keaiwa Reservoir (HA-0049) for
Failure to Comply with Notice of Deficiency, February 18, 2020

ATTACHMENT G

Summary Sheet of the Keaiwa Reservoir and Scorecard



Keaiwa Reservoir (HA-0049)
the Downstream Slope Near Inflows



5.49998°
124.898°

File: Keaiwa (175).JPG

Keaiwa Reservoir (HA-0049)
the Wall Has Been Shifted Back - Note Crack



5.50001°
124.857°

File: Keaiwa (127).JPG

Keaiwa Reservoir (HA-0049)
Concrete Panels in Mauka Section of Reservoir Basin



Keaiwa Reservoir HA-0049

- Recommended fine: \$15,000 fine
- Dam status: Empty; earthquake damage and stability concerns; unknown spillway capacity
- Owner's plan: Remove dam, or remediate and reduce capacity to non-jurisdictional size
 - Recently secured a consultant
 - Intends to submit permit app by June 2021 and start construction in 2022
- Plans to upgrade an existing level gage system to transmit data for real-time monitoring
- Owner was informed of dam deficiencies in reports and notices dating back to 2006, but no long-term safety improvements have been completed

Keaiwa Reservoir (HA-0049)
a Reservoir From Piped Inflows

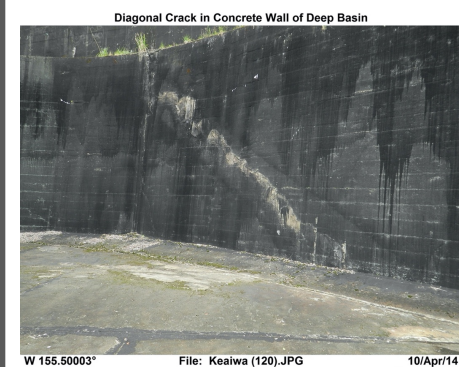
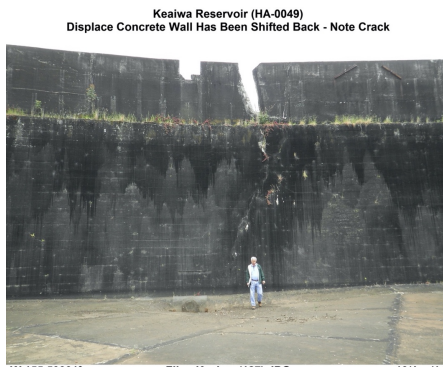


016°
124.89°

File: Keaiwa (175).JPG



SCORECARD											
Owner	Dam ID	Dam Name	Dam Status	Owner's Plan	Level Gage	Monthly Reports	Consultant Retained	Studies	Permit Application	Construction Start	Action Recommended
Typical cost of remediation -->					\$12-15K	No Cost	\$50-100K	\$50-200K	\$10-30K	>\$500K	
Olson Trust	HA-0049	Keaiwa	Empty, flow pool	Remove, or reduce cap to non-juris size	5/30/20	Done	4/1/20	6/30/20	6/30/21	6/30/22	\$15,000 fine
					Pending		1/25/21	TBD	TBD	TBD	
			Recommended fine amount -->		\$5,000			\$10,000			
					GREEN rating:	Done or completed		RED rating:	"No," or missed deadline and no plan (TBD)		



Keaiwa (HA-0049) Scorecard & Penalty Breakdown